Digestible lysine requirements of male and female broilers from fourteen to twenty-eight days of age[1]

W. A. Dozier III,*[2,3] A. Corzo,† M. T. Kidd,† P. B. Tillman,‡ and S. L. Branton*

*USDA-Agricultural Research Service, Poultry Research Unit, Mississippi State, MS 39762; †Department of Poultry Science, Mississippi State University, Mississippi State 39762; and ‡Ajinomoto Heartland LLC, Chicago, IL 60631

ABSTRACT There is little research data available on the digestible Lys requirement of broilers from 2 to 4 wk of age. Two experiments were conducted to determine the digestible Lys requirements of male and female Ross × Ross TP16 broilers from 14 to 28 d. Two diets (dilution and summit) consisting of corn, soybean meal, poultry by-product meal, and peanut meal were formulated to be adequate in all other amino acids. The dilution and summit diets were blended to create 9 titration diets. A control diet containing adequate Lys was used for comparison with the titration diets. A true Lys digestibility assay was conducted with cecectomized roosters to determine the values for the dilution (low) and summit (high) diets. True digestible Lys of the low and high dose-response diets were determined to be 0.84 and 1.21%, respectively. Body weight gain, feed intake, digestible Lys intake, digestible Lys intake:BW gain, feed conversion, and mortality were assessed during experimentation. Digestible Lys requirements were estimated using a quadratic broken-line model and a quadratic regression equation based on 95% of the optimum response. In experiment 1, the digestible Lys requirement for male Ross × Ross TP16 broilers was determined to be between 1.07 and 1.09% and 1.10 and 1.15%, for BW gain and feed conversion, respectively. In experiment 2, the digestible Lys requirement for female Ross × Ross TP16 broilers was estimated as 0.98% for BW gain determined with a quadratic broken-line model and 1.03 and 0.99% for feed conversion, respectively, using a quadratic regression equation based on 95% of the optimum response and the quadratic broken-line model. Digestible Lys requirements for male and female Ross × Ross TP16 broilers were estimated at 1.10 and 1.00%, respectively, based upon BW gain and feed conversion averaged for both statistical models.

Key words: digestible lysine, body weight gain, feed intake, feed conversion, mortality

2009 Poultry Science 88:1676–1682
doi:10.3382/ps.2008-00539

INTRODUCTION

Genetic selection by primary breeding companies has resulted in vastly improved growth rate, feed conversion, and breast meat yield of broiler chickens compared with broilers of the previous decade (Havenstein et al., 2003a,b; Dozier et al., 2008a,b). As a result, modern broilers require higher dietary amino acid concentrations to optimize performance and breast meat yield compared with the broilers of past years (Kidd et al., 2004; Dozier et al., 2008b). Part of the increased requirement has been achieved by reduced feed intake per unit of growth rate. Dietary Lys is central to breast muscle formation early in development (Tesseraud et al., 1996); thus, delineating the dietary Lys requirement is critical for the growing broiler.

Determined digestible Lys requirements for broiler chickens during the grower period (22 to 42 d of age) vary from 0.94 to 1.15% (Han and Baker, 1994; Leclercq, 1997; Mack et al., 1999). Digestible Lys requirement estimates vary by strain, sex, response criteria, and statistical model. In commercial practice, broilers are provided grower diets at an earlier age than 3 to 6 wk of age as published by the NRC (1994). As such, data on digestible Lys requirements are sparse from 2 to 4 wk of age, which more closely resembles a grower period used by the US broiler industry.

A method for defining amino acid requirements is to express them as a percentage of Lys, which is referred to as the ideal amino acid concept. After the digest-

Received December 10, 2008.
Accepted April 13, 2009.
[1]Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the USDA or Mississippi State University.
[2]Current address: Auburn University, Department of Poultry Science, 201 Poultry Science Building, 260 Lem Morrison Drive, Auburn, AL 36849-5416.
[3]Corresponding author: bill.dozier@auburn.edu

ible Lys requirement has been delineated for a certain genotype and environmental conditions, the other nondispensable amino acid requirements can be calculated as a ratio to Lys (Baker et al., 2002). Hence, it is of utmost importance to ascertain accurate digestible Lys requirements of modern broilers because other dietary amino acid requirements are expressed as a ratio to digestible Lys.

Most requirement studies have used the broiler male exclusively with limited data being available on the Lys needs of the female broiler. This study, therefore, examined digestible Lys requirements of both male and female broilers from 14 to 28 d of age.

MATERIALS AND METHODS

Dietary Treatments

Ten diets were fed from 14 to 28 d of age. Two diets consisting of corn, soybean meal, poultry by-product meal, and peanut meal were formulated to meet or exceed NRC (1994) nutrient requirements and contained 0.85 or 1.25% digestible Lys (Table 1). Diets were formulated using ideal amino acid concept to ensure adequacy of essential amino acids so the Lys response would not be limited. The 2 diets were mixed in varying proportions to create calculated 9 dose-response diets ranging from 0.85 to 1.25% in 0.05% graduations. Diet dilution technique was used because the high-Lys diet was formulated to contain 0.53% L-Lys·HCl and the low-Lys diet contained only 0.01% L-Lys·HCl; otherwise, these diets were similar in ingredient composition with L-Lys·HCl being removed with the addition of corn in the low-Lys diet. This was done so treatment differences would be due to added L-Lys·HCl. The control diet was formulated to contain 1.25% digestible Lys and was used to validate the high (1.25%) dose-response diet. Corn, soybean meal, poultry by-product meal, and peanut meal were analyzed for total amino acid (method 985.28, 994.12; AOAC, 2006) and CP (method 968.06; AOAC, 2006) composition. Digestible amino acid values were determined from digestible coefficients (Ajinomoto Heartland LLC, 2004) and analyzed total amino acid content of the ingredients. Digestible TSAA, Thr, Val, Ile, Arg, and Trp concentrations were formulated based on a modification of digestible ratios reported by Lemme et al. (2004) with the ratios being increased by 2 percentage points to ensure that these essential amino acids were not limiting.

True Amino Acid Digestibility Assay

True amino acid digestibility of dose-response diets formulated to 0.85 and 1.25% digestible Lys, the control diet, corn, soybean meal, poultry by-product meal, and peanut meal were determined using cecectomized Single Comb White Leghorn roosters at the University of Georgia, Athens (Parsons, 1985; Table 2). A 35-g sample of the diet or ingredient was tube-fed to 6 or 8 cecectomized roosters. Roosters were individually housed and fasted 24 h before experimentation (Parsons, 1985). All excreta voided over the following 48-h period were collected and freeze-dried. Total amino acid concentrations in the diets and excreta were determined by Ajinomoto Heartland, LLC (method 994.12; AOAC, 2006). Performic acid oxidation (method 985.28; AOAC, 2006) was conducted before acid hydrolysis for the determination of Met and Cys, whereas all other amino acids were determined after acid hydrolysis.

Experiments 1 and 2

Bird Husbandry. All procedures relating to the use of live birds were approved by the USDA-Agricultural Research Service Animal Care and Use Committee at the Mississippi State location. Ross × Ross TP16 broiler chicks (experiment 1 = 1,632 males; experiment 2 = 1,152 females) were purchased from a primary breeder hatchery with both male and female chicks originating from the same breeder flock. Chicks were vaccinated at the hatchery for Marek's disease, Newcastle disease, and infectious bronchitis. Experiments were conducted simultaneously at 2 different locations. Male chicks were reared in a solid-side wall facility and fed a common diet until 14 d of age at USDA-Agricultural Research Service, whereas the females were subjected to similar conditions at Mississippi State University. At 14 d of age, chicks were equalized among 96 floor pens (0.09 m^2/bird; experiment 1 = 15 birds/pen; experiment 2 = 12 birds/pen). Each pen was equipped with a hanging feeder, a nipple drinker line, and used litter. Birds consumed feed and water on an ad libitum basis and experimental diets were provided in whole pellet form. Ambient temperature set points consisted of 33°C at placement until 4 d of age, 32°C from 5 to 9 d of age, 29°C from 10 to 14 d of age, 27°C from 15 to 23 d of age, and 25°C from 24 to 28 d of age. Actual ambient temperature and RH during experimentation were 26.8°C ± 0.9 SD and 50.7% ± 8.7 SD for experiment 1 and 25.2°C ± 1.6 SD and 59% ± 11.0, for experiment 2. Photoperiod was a continuous schedule with lighting intensities of 30 lx from 0 to 7 d of age, 10 lx from 8 to 22 d of age, and 3 lx from 23 to 28 d of age. Light intensity settings were verified at bird level (30 cm) using a photometric sensor with NIST-traceable calibration (403125, Extech Instruments, Waltham, MA) for each intensity adjustment. Birds and feed were weighed on d 14 and 28 for the determination of BW gain, feed intake, digestible Lys intake, digestible intake:BW gain, and feed conversion. Mortality was recorded daily. Pellet durability index of the dose-response diets and the control diet were determined in duplicate by a standard procedure (ASAE, 1993). Dose-response diets and the control diet had a pellet durability index of 76.7 and 69.6%, respectively.

Table 1. Ingredient and calculated composition of diets provided during a 14- to 28-d production period (%, as-fed basis)

Item	Low Lys	High Lys	Control
Ingredient, %			
Ground corn	62.27	61.75	55.16
Soybean meal (48% CP)	20.30	20.30	31.24
Peanut meal (41% CP)	7.50	7.50	—
Poultry by-product meal	4.00	4.00	7.50
Poultry oil	1.99	1.99	3.22
Dicalcium phosphate	1.19	1.19	0.66
Calcium carbonate	0.88	0.88	0.72
Sodium chloride	0.23	0.23	0.56
Sodium bicarbonate	0.30	0.30	0.09
DL-Met	0.42	0.42	0.32
L-Lys·HCl	0.01	0.53	0.14
L-Thr	0.28	0.28	0.11
L-Val	0.18	0.18	—
L-Ile	0.15	0.15	—
L-Trp	0.03	0.03	—
Choline chloride	0.08	0.08	0.08
Mineral and vitamin premix[1]	0.15	0.15	0.15
Cocciodostat[2]	0.05	0.05	0.05
Calculated analysis			
AME_n, kcal/kg	3,126	3,126	3,129
CP, %	20.57	21.00	23.60
Digestible TSAA, %	0.94	0.94	0.94
Digestible Lys, %	0.85	1.25	1.25
Digestible Thr, %	0.85	0.85	0.85
Digestible Ile, %	0.91	0.91	0.96
Digestible Val, %	0.97	0.97	1.00
Digestible Trp, %	0.20	0.20	0.21
Digestible Arg, %	1.12	1.12	1.17
Calcium, %	0.88	0.88	0.88
Nonphytate phosphorus, %	0.44	0.44	0.44
Sodium, %	0.23	0.23	0.22

[1]Vitamin and mineral premix includes the following per kilogram of diet: vitamin A (vitamin A acetate), 4,960 IU; vitamin D (cholecalciferol), 1,653 IU; vitamin E (DL-α tocopherol acetate), 27 IU; menadione (menadione sodium bisulfate complex), 0.99 mg; vitamin B_{12} (cyanocobalamin), 0.015 mg; folic (folic acid), 0.8 mg; D-pantothenic acid (calcium pantothenate), 15 mg; riboflavin (riboflavin), 5.4 mg; niacin (niacinamide), 45 mg; thiamin (thiamin mononitrate), 2.7 mg; D-biotin (biotin), 0.07 mg; pyridoxine (pyridoxine hydrochloride), 5.3 mg; manganese (manganous oxide), 90 mg; zinc (zinc oxide), 83 mg; iron (iron sulfate monohydrate), 121 mg; copper (copper sulfate pentahydrate), 12 mg; iodine (calcium iodate), 0.5 mg; selenium (sodium selenite), 0.3 mg.

[2]Sacox 60 provided 60 g/907 kg of salinomycin.

Statistics. In experiments 1 and 2, gradient treatment structure was conducted as a randomized complete block design. The 9 dose-response diets were represented with 10 replicate pens, whereas the control diet had 6 replicate pens. The analyzed digestible Lys values were used in the statistical analyses with treatments levels ranging from 0.84 to 1.21% in increments of 0.046% (Table 2). Six analyses were conducted: 1) PROC REG (SAS Institute, 2004) using linear response to explain potential digestible Lys effects; 2) PROC REG (SAS Institute, 2004) using quadratic response to explain potential digestible Lys effects; multiple coefficient determination values presented are based on proportion of the treatment effect that is explained by the response; 3) PROC MIXED (SAS Institute, 2004) using linear response to explain potential digestible Lys effects; 4) PROC MIXED (SAS Institute, 2004) using quadratic response to explain potential digestible Lys effects; lack of fit for this analysis is the treatment effect that is not being explained by the response, and a measure of lack of fit as a component of variance was obtained from PROC MIXED; 5) an orthogonal contrast was conducted to compare the control diet (1.23% digestible Lys) vs. 1.21% digestible Lys from the dose-response diet; 6) the quadratic broken-line model was conducted using PROC NLIN (SAS Institute, 2004)

Table 2. True amino acid digestibility of the experimental diets provided to cecectomized roosters[1]

Amino acid	Low Lys diet	High Lys diet	Control
Lys	0.84	1.21	1.23
Met	0.61	0.62	0.58
Cys	0.23	0.23	0.25
Thr	0.89	0.81	0.80
Ile	0.71	0.72	0.72
Val	0.81	0.83	0.80
Arg	1.39	1.42	1.48
Leu	1.46	1.47	1.64
His	0.44	0.43	0.51
Phe	0.83	0.85	0.96
Ala	0.44	0.87	1.01
Asp	1.68	1.71	1.98
Glu	3.13	3.19	3.53
Pro	0.91	0.97	0.93
Ser	0.83	0.84	0.95
Tyr	0.52	0.53	0.58

[1]Amino acid digestibility values were determined using the total excreta collection precision-fed cecectomized rooster assay (Parsons, 1985).

Table 3. Growth performance of male broilers fed gradient additions of digestible Lys from 14 to 28 d of age[1] (experiment 1)

Item	BW, kg	BW gain, kg	Feed intake, kg	Lys intake, mg/d	Lys intake:BW gain, mg/g	FCR,[2] kg:kg	Mortality, %
Digestible Lys, %							
0.84	1.504	0.983	1.618	970	13.82	1.641	1.3
0.89	1.539	1.015	1.647	1,047	14.46	1.611	2.7
0.93	1.611	1.087	1.701	1,130	14.56	1.552	0.7
0.98	1.661	1.137	1.725	1,207	14.88	1.518	0.0
1.02	1.701	1.172	1.733	1,262	15.09	1.479	0.0
1.07	1.678	1.150	1.714	1,310	15.97	1.465	1.3
1.12	1.683	1.165	1.703	1,363	16.39	1.452	0.0
1.16	1.680	1.165	1.719	1,425	17.14	1.467	0.0
1.21	1.702	1.180	1.712	1,480	17.57	1.448	0.7
Control (1.23%)	1.764	1.249	1.736	1,525	17.09	1.393	0.0
SEM	0.020	0.024	0.019	14	0.14	0.010	0.8
Source of variation	Probability						
Linear response	0.003	0.002	0.038	0.0001	0.0004	0.0003	0.14
Quadratic response	0.005	0.005	0.0009	0.003	0.042	0.001	0.34
Control vs. 1.21%[3]	0.45	0.30	0.90	0.36	0.18	0.03	0.17

[1]Vaules are least squares means of 10 replicate pens with 15 broilers per pen at 14 d of age. Control birds were represented with 6 replicate pens.

[2]FCR = feed conversion ratio.

[3]Orthogonal contrast.

based on Robbins et al. (2006). Quadratic equation and broken-line models were used to estimate digestible Lys requirements. With the regression equation, the digestible Lys requirement was estimated at 95% of the response when a quadratic response was observed ($P \leq 0.05$). Digestible Lys requirement was also estimated using broken-line methodology when a significant ($P \leq 0.05$) response occurred.

RESULTS

True digestible Lys of the low-Lys, high-Lys, and the control diets was in close agreement with the calculated values (Table 2). True digestible Lys content for the low- and high-Lys diets was determined as 0.84 and 1.21%, respectively. However, calculated values for TSAA, Ile, Val, and Arg differed between the analyzed values for the control and high-Lys diet. Digestible Lys values of corn, soybean meal, poultry by-product meal, and peanut meal were determined as 0.22, 2.88, 1.67, and 1.28%, respectively. A lower digestible coefficient led to the lower digestible Lys content of the poultry by-product meal used in this study, and total Lys was higher for the peanut source than published in an amino acid ingredient table (Ajinomoto Heartland LLC, 2004).

Experiment 1

Significant quadratic responses ($P \leq 0.005$) were observed for BW, BW gain, feed intake, and feed conversion with broilers fed progressive additions of digestible Lys (Table 3). Gradient increments of digestible Lys resulted in linear increases ($P \leq 0.001$) of Lys intake and Lys intake:BW gain. The control-fed broilers had improved feed conversion ($P \leq 0.03$) compared with broilers provided the high-Lys dose-response diet. Growth rate, feed intake, digestible Lys intake, digestible Lys intake:BW gain, and mortality were similar for birds fed the control and high Lys of the dose-response diets. The digestible Lys requirement was estimated at 1.07 and 1.10%, respectively, for BW gain and feed conversion based on quadratic regression equations at 95% of the response (Table 4). With the broken-line quadratic model, digestible Lys requirements were predicted as 1.09 and 1.15%, respectively, for BW gain and feed conversion (Table 5). The digestible Lys requirement for BW gain and feed conversion was estimated as 1.10%

Table 4. Digestible Lys requirement of male and female broilers from 14 to 28 d of age based on quadratic regression analysis

Response criteria	Equation[1]	R^2	CV,[2] %	Requirement[3]
Males – experiment 1				
BW gain, kg	$-1.788 + 5.224 \times (\text{Lys}) - 2.300 \times (\text{Lys} \times \text{Lys})$	0.95	1.75	1.07
Feed conversion, kg:kg	$4.021 - 4.418 \times (\text{Lys}) + 1.898 \times (\text{Lys} \times \text{Lys})$	0.98	0.80	1.10
Females – experiment 2				
Feed conversion, kg:kg	$3.725 - 3.852 \times (\text{Lys}) + 1.766 \times (\text{Lys} \times \text{Lys})$	0.89	0.90	1.03

[1]Prediction equation based on formulated digestible Lys for optimum response.

[3]Coefficient of variation = (SD/mean) × 100.

[3]Digestible Lys requirement estimates 95% of the maximum or minimum response.

Table 5. Digestible Lys requirement based on quadratic broken-line model analyses

Response criteria	Estimated requirement[1]	95% CI[2]	Probability value
Males – experiment 1			
BW gain, kg	1.09 ± 0.04	1.00 to 1.17	0.0001
Feed conversion, kg:kg	1.15 ± 0.02	1.10 to 1.20	0.0001
Females – experiment 2			
BW gain, kg	0.98 ± 0.10	0.78 to 1.19	0.014
Feed conversion, kg:kg	0.99 ± 0.06	0.87 to 1.11	0.0003

[1]The quadratic broken-line model is y = L + U × (R − x) × (R − x), where L is the ordinate, U is the random component of the slope, R is the abscissa of the breakpoint, and the value R − is zero at values of x > R. Values are reported as ± SEM.

[2]95% CI = 95% confidence interval of the digestible Lys requirement.

when averaging the results from quadratic regression equations and quadratic broken-line models.

Experiment 2

Response to digestible Lys led to linear increases ($P \leq 0.01$) in BW, BW gain, digestible Lys intake, and digestible Lys intake:BW gain and significant quadratic responses ($P \leq 0.02$) for feed intake and feed conversion (Table 6). Dietary Lys did not significantly alter the incidence of mortality. Feeding female broilers the high-Lys dose-response diet provided similar growth performance as birds fed the control diet. The digestible Lys requirement was not estimated for BW gain due to the lack of a significant quadratic response. The digestible Lys requirement was determined as 1.03% for feed conversion based on the quadratic regression equation at 95% of the optimal response (Table 4). Conversely, digestible Lys requirements were estimated at 0.98 and 0.99%, respectively, for BW gain and feed conversion using the broken-line methodology (Table 5). The digestible Lys requirement was estimated as 1.00% when the requirement estimates were averaged for quadratic regression equations and quadratic broken-line models.

DISCUSSION

Feeding diets deficient in the test amino acid is important for conducting amino acid requirement assays. In the current research, male and female broilers fed the low-Lys diet resulted in reduced growth when compared with the addition of L-Lys to the dose-response diets, providing evidence that the low-Lys diet was deficient from 14 to 28 d of age. A summary of digestible Lys requirements for broilers from 2 to 4 wk of age is presented in Table 7. In the present research, the digestible Lys requirements from 14 to 28 d of age for male and female broilers and averaged for BW gain and feed conversion were estimated at 1.10 and 1.00%, respectively. A more accurate requirement could have possibly been estimated for female broilers if the deficient diet was lower than 0.84% digestible Lys. Female broilers had only a 0.05-kg differential increase in BW gain as digestible Lys increased from 0.84 to 0.93%, whereas a 0.107-kg increase in BW gain occurred with male broilers fed the 3 lowest digestible Lys levels. The smaller differential in BW gain with females fed the 3 lower Lys levels infers that 0.84% digestible Lys was not deficient as observed with males. Moreover, it appears

Table 6. Growth performance of female broilers fed gradient additions of digestible Lys from 14 to 28 d of age[1] (experiment 2)

Item	BW, kg	BW gain, kg	Feed intake, kg	Lys intake, mg/d	Lys intake:BW gain, mg/g	FCR,[2] kg:kg	Mortality, %
Digestible Lys, %							
0.84	1.329	0.886	1.547	943	14.92	1.747	0.0
0.89	1.354	0.917	1.549	985	15.09	1.683	0.8
0.93	1.376	0.936	1.558	1,035	15.52	1.660	0.8
0.98	1.382	0.939	1.534	1,074	16.04	1.637	0.0
1.02	1.343	0.903	1.501	1,094	16.97	1.661	0.8
1.07	1.352	0.925	1.502	1,148	17.41	1.624	0.8
1.12	1.392	0.949	1.535	1,228	18.19	1.625	0.0
1.16	1.402	0.958	1.556	1,290	18.85	1.625	0.0
1.21	1.400	0.949	1.566	1,354	19.99	1.652	0.0
Control (1.23%)	1.422	0.969	1.571	1,364	19.75	1.624	0.0
SEM	0.020	0.019	0.020	21	0.28	0.025	0.5
Source of variation	Probability						
Linear response	0.010	0.010	0.91	0.0001	0.0001	0.024	0.39
Quadratic response	0.86	0.75	0.022	0.007	0.010	0.008	0.23
Control vs. 1.21%[3]	0.33	0.33	0.32	0.31	0.76	0.75	—

[1]Vaules are least squares means of 10 replicate pens with 12 broilers per pen at 14 d of age. Control birds were represented with 6 replicate pens.

[2]FCR = feed conversion ratio.

[3]Orthogonal contrast.

Table 7. Summary of digestible Lys requirements of 2- to 4-wk-old broilers

References	Age, d	Sex	Genetics	Digestible Lys,[1] %	Digestible Lys intake,[1] mg/d
Present research	14 to 28	Males	Ross × Ross TP16	1.10	1,337
Present research	14 to 28	Females	Ross × Ross TP16	1.00	1,084
Rostagno et al., 2007	10 to 21	Males	Cobb × Cobb 500	1.16	888
Rostagno et al., 2007	10 to 21	Females	Cobb × Cobb 500	1.12	789
Rostagno et al., 2007	22 to 35	Males	Cobb × Cobb 500	1.04	1,625
Rostagno et al., 2007	22 to 35	Females	Cobb × Cobb 500	1.10	1,538
Labadan et al., 2001	14 to 28	Mixed-sex	Ross × Avian	0.99	838

[1]Values are based on the average digestible Lys requirements for BW gain and feed conversion efficiency (present research), feed conversion efficiency (Rostagno et al., 2007), or BW gain (Labadan et al., 2001).

that only 2 levels were provided below the requirement for females, whereas males were fed 4 levels below their requirement. In addition, a lower R^2 with female broilers compared with male broilers denotes that female broilers should have been fed a lower digestible Lys level with more than 2 levels below their requirement.

Male broilers fed the control diet had superior feed conversion compared with broilers fed a similar digestible Lys level of the dose-response diet. The dose-response diet may have underestimated optimum response for feed conversion. The control-fed broilers consumed 1,525 mg/d of digestible Lys, whereas broilers fed the dose-response diet had a digestible Lys intake of 1,480 mg/d. The control-fed broilers also consumed an additional 103 mg/d of digestible Arg and 15 mg/d of digestible Ile than the dose-response-fed broilers. Superior feed conversion of the control-fed broilers may be due to higher intakes of digestible Lys, Arg, and Ile.

The digestible Lys requirement for feed conversion was higher than BW gain for both sexes. This observation has been previously reported for dietary Lys (Han and Baker, 1994; Leqclercq, 1997; Mack et al., 1999; Baker et al., 2002). Feed intake and BW gain increases to a maximum as dietary Lys approaches the requirement for growth. Then, as dietary Lys concentration increases above the requirement for growth, growth rate is maintained while feed intake decreases, resulting in a higher dietary Lys requirement for feed conversion than BW gain or feed intake (Baker et al., 2002). For other critical amino acids, it is common to observe similar requirements for BW gain and feed conversion.

Digestible Lys requirements for BW gain and feed conversion were 10% higher for male vs. female broilers in the research reported herein. Body weight gain and digestible Lys intake were 26 and 23% higher for male vs. female broilers at their respective requirement estimates. This increased growth rate and digestible Lys intake help explain the elevated digestible Lys requirements of male broilers. Previous research has shown higher Lys requirements for male than female broilers. Han and Baker (1994) reported that male broilers from 22 to 43 d of age had 4.5 and 8.2% higher digestible Lys requirements for BW gain and feed conversion than female broilers. Moreover, Dozier et al. (2008a) determined that the digestible Lys requirement for 49- to 63-d-old Ross × Ross 708 male broilers was 7% (0.87 vs. 0.81%) higher than female broilers.

Rostagno et al. (2007) reported the digestible Lys requirements for Cobb 500 male and female broilers as 1.16 and 1.12% (from 10 to 21 d of age) and 1.04 and 1.10% (from 22 to 35 d of age), respectively, based on feed conversion. Male broilers had a digestible Lys intake of 888 mg/d (from 10 to 21 d of age) and 1,625 mg/d (22 to 35 d of age), and female broilers consumed 789 mg/d (from 10 to 21 d of age) and 1,538 mg/d of digestible Lys (from 22 to 35 d of age) at their respective requirements. From 10 to 21 d of age, male and female broilers displayed higher requirement estimates than data reported herein. From 22 to 35 d of age, digestible Lys requirement was higher for females than male broilers. This observation is in contrast to the current data and previous research (Han and Baker, 1994; Dozier et al., 2008a). It appears that the lowest digestible Lys concentrations used by Rostagno et al. (2007) with broilers from 10 to 21 and 22 to 35 d of age may not have been sufficiently deficient, particularly for females. For example, 22- to 35-d feed conversion of females decreased 1 percentage point as digestible Lys increased at the 2 lowest digestible Lys concentrations (from 0.92 to 0.98%) with only a 5-point spread in feed conversion (1.81 vs. 1.76) among the digestible Lys treatments (from 0.92 to 1.10%).

Labadan et al. (2001) reported the Lys requirement from 2 to 4 wk of age for Ross × Avian mixed-sexed broilers as 1.13% (0.99% digestible Lys). The present research resulted in a 6% higher Lys requirement when averaged across both sexes as compared with work reported by Labadan et al. (2001). The higher Lys requirement reported by the current research and Rostagno et al. (2007) probably relates to increased growth rate and decreased feed intake:BW gain of the modern broiler (Havenstein et al., 2003a). In the present research, male broilers at the estimated digestible Lys requirement had daily growth rate, feed intake, and digestible Lys intake of 83 g/d, 122 g/d, and 1,337 mg/d, respectively. Female broilers displayed BW gain, feed intake, and digestible Lys intake of 66 g/d, 108 g/d, and 1,084 mg/d, respectively. Body weight gain and digestible Lys intake of the Ross × Ross TP16 broilers are higher than we would expect from other strains of Ross broilers used in production. For comparison purposes, NRC (1994) estimates BW gain and feed intake from 2 to 4 wk of age for male and female broilers as 51 and 85, and 44 and 78 g/d, respectively. Male and female broilers in the current research had 162 and 150% greater growth rate, respectively, compared with estimates from NRC (1994). The increased growth by the modern broiler supports a higher digestible Lys need than previously reported (NRC, 1994; Labadan et al., 2001) for broilers from 2 to 4 wk of age.

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